universität innsbruck
Forschungsschwerpunkt Physik

Innsbruck
Physics Colloquium

Vortex matter in strongly-interacting Fermi superfluids

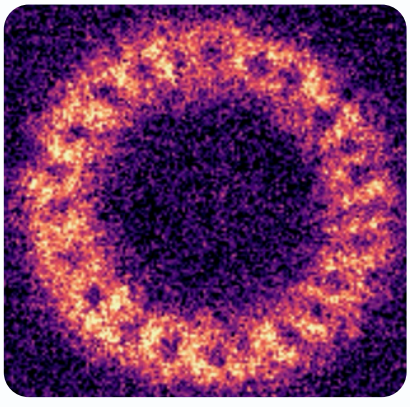
Colloquium talk
with

Giacomo Roati

CNR-INO and LENS

Topological defects play a fundamental role in shaping the properties and structures of diverse out-of-equilibrium physical and biological systems across a wide range of scales. These include planetary atmospheres, turbulent flows in classical and quantum fluids, and electrical signaling in excitable biological media [1]. In superfluids and superconductors, the motion of quantized vortices is tied to the onset of dissipation, which limits the superflow [2]. Understanding vortex dynamics remains a challenge due to the complex interplay among vortices, disorder and system dimensionality. We address this challenge by exploring vortex matter in planar homogeneous atomic Fermi superfluids [3]. By designing specific vortex configurations and tracking their trajectories with high spatial resolution, we transform our system into an ideal “quantum laboratory” for probing the fundamental nature of vortex-driven instabilities and dissipation [4,5]. Our research paves the way for deeper insights into vortex-matter phenomena in strongly correlated superfluids.

[1] Spiral and Vortices, K. Tsuji and S. C. Müller Editors, Springer Nature (2019)
[2] B. I. Halperin, G. Refael and E. Demler, Int. J. Mod. Phys, B 24, 20n21 (2010)
[3] W. J. Kwon et al., Nature, 600 (2021)
[4] D. Hernandez-Rajkov et al., Nat. Phys. 20 (2024)
[5] N. Grani et al., arXiv:2503.21628v1 (2025)



Tuesday, 29 April, 16:30

HS C, Victor-Franz-Hess-Haus

Organizers: Katrin Erath-Dulitz, Hanns-Christoph Nägerl, Francine Marleau